

REMARKS

Claims 13, 14 and 16 are pending in this application, of which claim 13 has been amended. No new claims have been added.

The Examiner has maintained from the previous Office Action the 35 USC §103(a) rejections of claims 13-14 and 16 as unpatentable over **Ishida et al.** in view of **Yamakage**.

Applicants respectfully traverse this rejection.

Ishida et al. discloses a heat pipe type cooler having a base plate 1 and a plurality of upright heat pipes attached to an upper side of base plate 1. Fins 3 are attached to arm portions 2b of the heat pipe. Fan 4 is provided for forced air cooling.

The Examiner has admitted that **Ishida et al.** fails to disclose a larger fin distance between base plate 1 and fin 3 than between adjacent fins 3, but has cited **Yamakage** for teaching this feature.

Applicants respectfully disagree. Fig. 6 of **Yamakage** shows a duct 7 and fan 8 enclosing fins 6 attached to an upper end of hollow heat pipes 4c, where the lower ends of hollow heat pipes 4b are filled with liquid coolant 5. Fig. 6 teaches no more than the fins 6 being enclosed by the duct 7, where the space between duct 7 and lowest fin 6 appear to be the same as the spacing between each of the other fins 6.

Ishida et al. has also been applied to teach the U-shape of the heat pipe now claimed.

Fig. 2 of Ishida et al. shows that the base plate 1 is also a wall of the casing (duct) 5. Therefore, the casing 5 must be designed integrally with the base plate 1, which somewhat limits the design of the casing 5. In addition, the heat conducts over the entire casing 5 because the base plate 1 is integral with the casing 5, and some elements located around the casing 5 may be affected by the heat.

The present invention solves these problems.

Yamakage shows the metal block 2 arranged outside the duct 7. Therefore, Yamakage cannot be combined with Ishida et al. to teach the present invention.

The present invention is different from Yamakage in the following points.

In Yamakage, the metal block 2 is not a heat receiving plate having lower and upper opposite surfaces. The semiconductor element 1 does not contact the lower surface of the metal block 2, but it instead contacts the side surface of the metal block 2 (see Fig. 5). The heat pipes 4 are not fixed to the upper surface of the metal block 2, but they are instead inserted in the holes 3 of the metal block 2. The metal block 2 has a volume and a mass which are greater than those of the heat receiving plate of the present invention. The fins 6 are smaller than the metal block 2.

Therefore, it is not appropriate to correspond the metal block 2 to the heat receiving plate of the present invention. Thus, Yamakage does not show the fin distance relationship of the present invention, as discussed above.

In Yamakage, the heat is dissipated directly from the metal block 2 having the greater volume and the greater mass, to the surrounding space, and some elements located around the metal block 2 may be affected by the heat, as well as the amount of the heat conveyed from the metal block 2 to the fins 6 in the duct becoming smaller.

In the present invention, the heat receiving plate (which is considerably thin relative to the metal block 2) is arranged outside the duct and near the duct, and some elements located around the heat receiving plate may not be affected by the heat, as well as the amount of the heat conveyed from the heat receiving plate to the fins (which are large relative to the fins of Yamakage) in the duct becoming large. Accordingly, the heat generated by the heat generating element is effectively conveyed to a remote plate via the heat receiving plate, the heat pipes, the fins and the duct.

Therefore, the heat pipe cooler of the invention can effectively cool the semiconductor element having a very densely designed circuit, without affecting an element located around the semiconductor element. The duct can be designed with more freedom.

Claim 13 has been amended to recite that the heat receiving plate is arranged outside the ventilation duct, in contrast to Ishida et al., where the base plate is also a wall of the casing (duct).

Thus, the 35 USC §103(a) rejection should be withdrawn.

In view of the aforementioned amendments and accompanying remarks, claims 13, 14 and 16, as amended, are in condition for allowance, which action, at an early date, is requested.


U.S. Patent Application Serial No. 09/044,030
Response to Office Action dated March 23, 2004

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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Enclosures: Petition for Extension of Time

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